

WHAT IS CLAIMED IS:

1. A method of producing a fibrous preform, comprising:
moving a needle-penetrable mold plate containing a discontinuous fiber material relative to a needling device along a first direction, the needling device including a needle member;
while moving the needle-penetrable mold plate containing the discontinuous fiber material along the first direction relative to the needling device, passing the needle member through the fiber material to change a fiber orientation of at least some of the discontinuous fiber material until a predetermined fiber content percentage of the needled discontinuous fiber material is obtained; and
permitting the needle-penetrable mold plate to at least occasionally move along a second direction generally transverse to the first direction.
2. The method according to claim 1, wherein moving the needle-penetrable mold plate containing the discontinuous fiber material relative to the needling device along the first direction comprises moving the needle-penetrable mold plate containing the discontinuous fiber material relative to the needling device a plurality of times along the first direction.
3. The method according to claim 1, further comprising at least occasionally moving the needle-penetrable mold plate containing the discontinuous fiber material along a second direction generally transverse to the first direction comprises occasionally moving the needle-penetrable mold plate along the second direction while moving the needle-penetrable mold plate along the first direction.

4. The method according to claim 1, wherein the predetermined fiber content percentage is between about 25% to about 35%.

5. The method according to claim 1, wherein the discontinuous fiber material comprises discontinuous PAN-based carbon fiber.

6. The method according to claim 1, wherein the discontinuous fiber material comprises discontinuous pitch-based carbon fiber.

7. The method according to claim 1, wherein the discontinuous fiber material comprises discontinuous PAN-based carbon fiber and discontinuous pitch-based carbon fiber.

8. The method according to claim 7, wherein at least occasionally moving the needle-penetrable mold plate containing the discontinuous fiber material along a second direction generally transverse to the first direction comprises occasionally mechanically moving the needle-penetrable mold plate along the second direction.

9. The method according to claim 7, wherein at least occasionally moving the needle-penetrable mold plate containing the discontinuous fiber material along a second direction generally transverse to the first direction comprises occasionally manually moving the needle-penetrable mold plate along the second direction.

10. The method according to claim 1, wherein the discontinuous fiber material is provided in a mold cavity defined in the needle-penetrable mold plate.

11. The method according to claim 10, wherein the mold cavity defined in the needle-penetrable mold plate is generally circular.

12. The method according to claim 11, wherein the needle-penetrable mold plate includes a core positioned at a central part of the mold cavity so as to define an annular space into which the discontinuous fiber material is received.

13. The method according to claim 1, wherein the needling device is a needle loom.

14. The method according to claim 13, wherein the needle loom is a linear needle loom.

15. The method according to claim 1, wherein passing the at least one needle member through the discontinuous fiber material comprises passing the needle member through opposing sides of the discontinuous fiber material.

16. The method according to claim 15, wherein passing the needle member through opposing sides of the discontinuous fiber material comprises using a first needling device to pass a first needle member through the discontinuous fiber material from a first side of the needle-penetrable mold plate and using a second

needling device to pass a second needle member through the discontinuous fiber material from a second side of the needle-penetrable mold plate opposite to said first side of the needle-penetrable mold plate.

17. The method according to claim 16, wherein the first and second needling devices are both provided in the same linear needle loom.

18. The method according to claim 2, wherein passing the needle member through the discontinuous fiber material comprises passing the needle member through opposing sides of the discontinuous fiber material, the method further including inverting the needle-penetrable mold plate relative to the needle member between respective movements of the needle-penetrable mold plate relative to the needling device.

19. The method according to claim 1, further including passing the needle member through a part of the needle-penetrable mold plate.

20. The method according to claim 1, wherein moving the needle-penetrable mold plate along the first direction includes moving the needle-penetrable mold plate along an upward angle with respect to the first direction.

21. The method according to claim 1, further comprising carbonizing the discontinuous fiber material after attaining the predetermined fiber content percentage.

22. The method according to claim 21, further comprising densifying the carbonized discontinuous fiber material.

23. The method according to claim 22, further comprising heat treating the densified carbonized discontinuous fiber material.

24. The method according to claim 1, wherein the needle-penetrable mold plate includes a plurality of mold cavities into which the discontinuous fiber material is received, the plurality of mold cavities being arranged generally transverse to the first direction.

25. The method according to claim 1, wherein the needle-penetrable mold plate includes a plurality of mold cavities into which the discontinuous fiber material is received, the plurality of mold cavities being arranged generally along the first direction.

26. The method according to claim 24, wherein the needle-penetrable mold plate includes a plurality of mold cavities into which the discontinuous fiber material is received, the plurality of mold cavities additionally being arranged generally along the first direction.

27. A method of producing a fibrous preform, comprising:

moving a needle-penetrable mold plate containing a discontinuous fiber material relative to a needling device along a first direction, the needling device including needle members arranged generally along the first direction;

while moving the needle-penetrable mold plate containing the discontinuous fiber material along the first direction, needling the discontinuous fiber material with the needle members to change a fiber orientation of at least some of the discontinuous fiber material, until a predetermined fiber content percentage of the needled discontinuous fiber material is obtained, the needling being performed to increasing depths into the discontinuous fiber material as the needle-penetrable mold plate moves along the first direction; and

allowing the needle-penetrable mold plate containing the discontinuous fiber material to move along a second direction generally transverse to the first direction.

28. A method of producing a fibrous preform, comprising:

moving a needle-penetrable mold plate containing a fiber material relative to a needling device along a first direction, the needling device including a needle member;

while moving the needle-penetrable mold plate containing the fiber material along the first direction relative to the needling device, passing the needle member through the fiber material to change a fiber orientation of at least some of the fiber material until a predetermined fiber content percentage of the needled fiber material is obtained; and

permitting the needle-penetrable mold plate to at least occasionally move along a second direction generally transverse to the first direction.

29. The method according to claim 28, wherein the fiber material is one of a non-woven carbon fabric and a continuous carbon filament.